Space Weather Technical Forecast

Issued on Friday, 06 September 2024 at 01:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-flares expected, chance of X-flares. Slight but increasing chance of S1/Minor Radiation Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been High over the past 24 hours with several low level M-flares, peaking at M2.8 at 05/0856 UTC from AR3807 on the west limb. There are currently eight sunspot regions on the visible disc, with AR3806 in the southwest remaining the largest and most complex region on the disc, with a large number of mostly small spots, including a couple of small delta spots. AR3813 in the southeast is only slightly smaller and magnetically less complex, than AR3806, and there are three other moderate complex regions on the disc. The remaining regions are smaller and magnetically simple. None of the eight regions showed significant growth or decay, although half of the regions did show some slight increase in size or spot number, including AR3806.
No Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind as measured by ACE and DSCOVR at L1 showed CME effects gradually waning. The wind speed was generally between 360-400 km/s, peaking at 425 km/s at 05/0015 UTC. Density was mostly below average. The Interplanetary Magnetic Field, Bt, was initially moderate with a peak of 10 nT, but gradually eased to become weak to end the day at 6 nT. The north-south component, Bz, was predominantly northward directed. Phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 has continued to decline following the response to the M5.5 flare on 01 Sep. The 24 hour peak was 3 pfu at 05/0305 UTC. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels, peaking at 257 pfu at 05/1650 UTC. The corresponding 24-hour fluence showed a falling trend well below the Active threshold, with 3.62e6 integrated pfu observed at 06/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is expected with a chance of isolated X-flares. The risk decreases very slightly on Day 2 (07 Sep) as AR3807 rotates well over the west limb.

Solar Wind / Geomagnetic Activity: Recent CME effects from the 01 Sep CME are now declining, with no further CMEs currently expected to arrive at Earth. A weak HSS associated with CH65/+ in the northern hemisphere may bring slightly elevated wind speeds on Day 2 and perhaps into Day 3 (07-08 Sep). Otherwise background wind speeds are expected.
On the whole, geomagnetic activity is expected to be largely Quiet (Kp 0-2), perhaps reaching Active (Kp 4) with a slight chance of G1/Minor Storms (Kp 5) on Day 2 into Day 3 should a connection with the HSS from CH65/+ occur.

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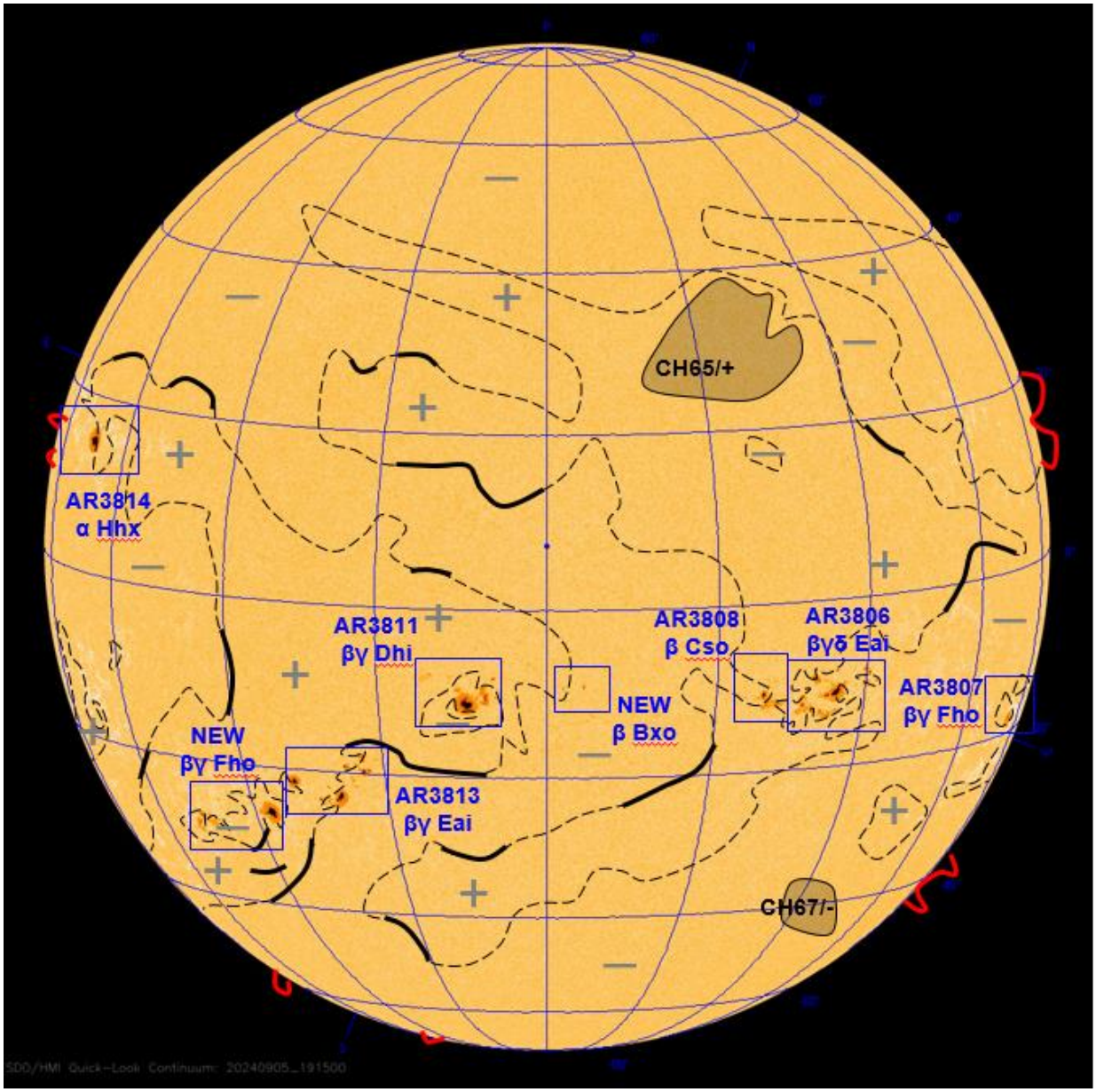
Energetic Particles / Solar Radiation: High energy proton flux is above background levels, but below the S1/Minor Radiation Storm threshold. There is a slight but increasing chance of exceeding S1 in the coming days. High energy electron flux is expected to remain at background to moderate levels, perhaps rising late in the period following any HSS effects. There is a slight chance of fluence reaching the Active threshold by the end of the period.

Figure 1. Solar Analysis Valid 05/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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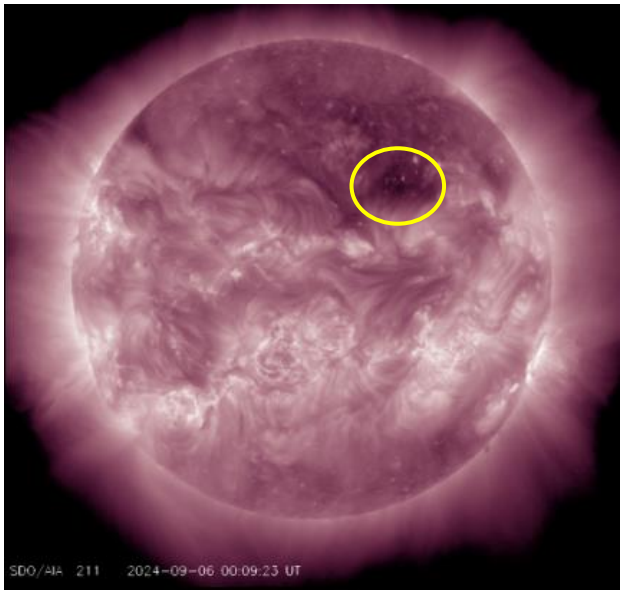
Geomagnetic Storms:

Recent CME effects from the large eruption off the southeast limb on 01 Sep are now declining, with no further CMEs currently expected to arrive at Earth.
Two coronal holes are in the western disc. CH67/- is well to the south and with Earth north of the solar equator it is not expected to influence the solar wind at Earth. CH65/+ is in the northern hemisphere, but appears to have weakened over recent days. Therefore only slightly elevated wind speeds may occur on Day 2 or perhaps into Day 3 (07-08 Sep). This coronal hole on the previous rotation was in a slightly different location, and the solar wind was contaminated by CME arrivals, so persistence is not a particularly helpful guide here. However, the coronal hole being positive it is more likely to give a slight geomagnetic response at Earth at this time of year.
MOSWOC Enlil is currently significantly overestimating the wind speed, modelling a broad and strong coronal hole which does not exist.
Overall geomagnetic activity is expected to be largely Quiet (Kp 0-2), perhaps reaching Active (Kp 4) with a slight chance of G1/Minor Storms (Kp 5) on Day 2 into Day 3 should a connection with the HSS from CH65/+ occur.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	15	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest SDO/AIA 211 showing the small and weak CH56.



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently eight sunspot regions on the visible disc. AR3806 in the southwest is the largest and most complex region on the disc, with a large number of mostly small spots, including a couple of small delta spots. AR3806 has shown some slight growth over recent hours, with minor penumbra development on some small leading spots. It is now starting to merge with AR3808 behind. AR3807 is now approaching the southwest limb, so the previous classification is maintained, but some growth is evident. AR3808 has shown some slight increase in penumbra and spot number, and maybe close to developing a weak delta spot. AR3811 has developed some small trailing spots and is now classified as beta-gamma. AR3813 is now becoming clearer to analyse as it rotates further on the disc, and is now classified as Eai/beta-gamma. Another region, unnumbered, follows closely behind and also appears to have a beta-gamma classification, although this region is closer to the southeast limb which makes it harder to analyse. Remaining regions are smaller and mostly stable.

Activity has been High over the past 24hrs, with several low level M-class flares, the peak being M2.8 at 05/0856 UTC from AR3807 on the west limb. Further M-class flares are expected, with a slight chance of isolated X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	70	70	70
Very Active	R3 to R5 X Class	No	20	15	15	15

Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is above background levels but slowly easing in response to the large eruption and associated M5.5 flare off the southeast limb on 01 Sep. However, it is considered unlikely to reach the S1/Minor Radiation Storm threshold at this time, in the absence of further notable flares.
There are several regions on the disc which could give an increase in proton flux, should they produce larger flares, including AR3807 and AR3806 in the western hemisphere. Normally AR3813 would be considered a low risk of exceeding S1 from its current location in the southeast quadrant, but given it has already produced a proton response at Earth from closer to the east limb this region poses the greatest risk of producing radiation storms, especially as it rotates westward.
Overall, there is a slight but increasing chance of reaching the S1 threshold in the coming days, should there be any larger flares from any of the aforementioned regions.

Radiation Storms	Level (cm^{-2}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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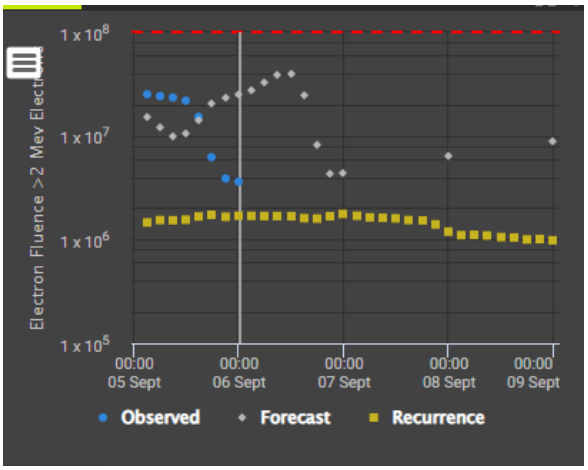
Probability (Exceedance)	$sr^{-1} s^{-1}$)	(Yes/No)	(%)	(%)	(%)	(%)
Active	≥ S1	No	20	25	25	25
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 has been at background to moderate levels. Any weak HSS from CH65 may result in a slight increase in the electron flux, with levels becoming mainly moderate, with a slight chance of reaching high levels.
Overall, the 24 hour fluence is expected to remain below the Active (1e8 integrated pfu) threshold, although with perhaps with a rising trend later in the period after any HSS from CH65 starts to ease. Therefore, there is a slight chance of exceeding the Active threshold by the end of the period. MOSWOC REFM will not be taking into account the upcoming potential HSS, but the overal trend of the fluence remaining below Active is accepted.

GEO Electron Environment	Level ($cm^{-2} sr^{-1} day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Met Office REFM.



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